

(12)

ON THE  
TREATMENT OF DIABETES

BY  
FREE PHOSPHORUS.

BY  
BALMANNO SQUIRE, M.B. LOND.



LONDON:  
J. & A. CHURCHILL,  
11, NEW BURLINGTON STREET.  
1889.

THE admitted inadequacy of the means at present available for the relief of Diabetes, and the obscurity which still hangs over the pathology of that disease, will, I trust, suffice to render excusable the publication of a research, however crude, which, aiming at the improvement of the former, may possibly tend to the elucidation of the latter.

B. S.

24, WEYMOUTH STREET, PORTLAND PLACE,  
*December 1889.*

ON THE  
TREATMENT OF DIABETES  
BY  
FREE PHOSPHORUS.

---

IN the *British Medical Journal* of November the thirtieth (1889) I reported the main facts of a case of Diabetes, in a gentleman aged sixty, which by chance not by design underwent treatment by phosphorus under my hands. The patient was brought to me to be treated for Eczema. I treated his Eczema by phosphorus; and under this treatment, not only his Eczema but also his Diabetes underwent rapid and marked improvement. The main facts that I thus recorded were, that after only ten days' treatment by phosphorus and local applications, the patient not only was nearly quite well as to his Eczema but was also very greatly better of his Diabetes.

I will here reprint my report from the columns of the *British Medical Journal*:—

‘As new therapeutical results are probably more

often the result of chance than of design on the part of the investigator, I may perhaps be held excused in communicating to you what, so far as I know, is a new and somewhat important therapeutical fact; but which, whatever it may be worth, is certainly not the result of any premeditated design on my part.

‘A gentleman, aged 60, was brought to me on October 29th by Dr. Williams Jones, of Manchester, who wished my advice as to his patient, who for a long time had been affected somewhat severely with Eczema of his face, neck, and upper limbs, including his hands. Dr. Jones had previously consulted two or three other practitioners as to his patient’s condition, and informed me that his patient, who had become much worn out from want of sleep, was now willing to do whatever might be required of him. Dr. Jones also informed me that his patient had for long been affected with Diabetes, for which he had treated him.

‘I suggested to Dr. Jones that, in addition to the local remedies which we agreed on, the patient should take phosphorus “perles” for the improvement of the Eczema. To this Dr. Jones saw no objection. I accordingly proposed to him that the

patient should take one "perle" three times a day for three days; and that, should no nausea result from their use by the end of that time, the dose should then be increased to two "perles" three times a day. Owing to some difficulty in obtaining the "perles," the patient did not commence taking them until Nov. 1st, and, after the expiration of three days, Dr. Jones put his patient on the double dose.

'To-day (Nov. 11th) the patient visited me at Dr. Jones's request, and certainly as to his Eczema he is nearly quite well, and he tells me that he now enjoys sound sleep at night. Thus much I was quite prepared to hear. But I was a little astonished when he informed me that these were by no means the only benefits that he had derived. He was also greatly better of his Diabetes, very suddenly and very markedly so. He says that for the last four or five days he has been far better in this latter respect than he has been for many months. He had been used to being obliged to get out of bed four or five times in the night to pass water; but, for the last four or five days, he had not had any call of the kind at night. The quantity that he passed in the twenty-four hours had for long been a very consider-

able quantity, but it had suddenly diminished in amount very notably. The urine has until quite recently been very pale in colour, but now it presents a fairly natural degree of colour. He suffered from constant thirst, which he was compelled to assuage frequently. He is now no longer troubled with thirst. He travelled this time from Manchester to London without wanting anything to drink on the journey, and required to get out at Bedford only, to pass water. He assured me that his first journey to me was by no means so free of incidents either as to incomings or outgoings of liquid. He stated that he felt now very much better in health altogether. I requested him to pass water just before he left, but he felt so little inclination that he doubted whether he could. However, he passed about six fluid ounces.

‘Although I had no reason to doubt Dr. Jones’s diagnosis, I thought I would, before writing this note, obtain independent confirmation of the fact that the patient’s complaint was beyond doubt Diabetes. I accordingly asked my neighbour, Dr. Goodhart, to examine the urine for me. Dr. Goodhart, after remarking that the colour of the urine was somewhat exceptionally good for a diabetic,



found that its specific gravity was 1032, and that it contained plenty of sugar and no albumen. He has kindly permitted me to use his name for the purposes of this note so far as concerns these facts respecting the quality of the specimen of urine that I submitted to him.

. 'The quantity of phosphorus that the patient took may be estimated from the basis that each of the "perles" contained one-thirtieth of a grain of phosphorus dissolved in oil. So that, for the first three days of his phosphorus treatment, he took a tenth of a grain a day, and for the remaining seven days he took a fifth of a grain daily. From such experience as I have in the administration of phosphorus internally, I should be disposed to say that he was fairly under the influence of phosphorus; moreover, he has just begun to experience a slight but decided degree of nausea from its use.

'In what manner the phosphorus has acted in controlling the Diabetes, as it seems to me it unquestionably has acted, I am not prepared to offer any kind of opinion. That the administration of phosphorus acts most decidedly on the liver is well known, because, in undue and over-prolonged doses, phosphorus is capable of producing fatty degeneration

of the liver. This circumstance would seem to afford the clue to its marked action in this case in controlling Diabetes; but I am not prepared to assert that this is the correct explanation. It is possible that the effect of the phosphorus may be due to its action on the nervous system.

‘In any case, the circumstance seems to me well worthy of record, in the columns of the *Journal*, because I venture to think that, when the question comes to be sifted by observers more competent than myself, it will be found that phosphorus exerts a very potent action in the control of Diabetes.’

Here I may supply an obvious *hiatus* in my previous account: namely, that as to his Eczema the patient had suffered from it continuously and severely for one year and eight months, and that as to his Diabetes he had suffered from that continuously and somewhat gravely for the past five years. I ought also to have mentioned, that the patient was daily eating bread pretty freely during the time that he underwent the sudden and marked improvement of his Diabetes that was affected by the administration of phosphorus.

The proofs that I adduced as to the amendment of his Diabetes were, as I explained in my report,



derived solely from his own statements, for proof of other kind there was none. But he was an experienced diabetic of five years' standing, and moreover a man of considerable intelligence; so that I felt in a position to give credit to his statements. Still the apparent effect of the treatment on his Diabetes was to me so astonishing, that I thought it would be well worth the patient's while, that it should be ascertained beyond question of any kind, whether or not accident had revealed an improved means of relief for him for the future. So far as I know, or have as yet been able to ascertain, phosphorus has never before been prescribed with the object of benefiting cases of Diabetes.

It is true that I was not, in the first instance, called upon to treat the patient's Diabetes. His medical attendant (Dr. Williams-Jones) had applied to me, in my capacity of expert in skin diseases, to advise as to the treatment of the Eczema. I was not consulted as to the Diabetes, nor did I offer any advice as to it. I did not consider that I was likely to be able to tell Dr. Jones anything that he did not already know concerning Diabetes. On the contrary, I expressly put it to Dr. Jones, that the *onus* devolved on him of forbidding the

use of phosphorus, if he should by chance apprehend any *aggravation* of the Diabetes from the employment of phosphorus. It was agreed between us that the treatment of the patient as regards his Diabetes, should be left unreservedly in Dr. Jones' hands. Phosphorus was accordingly prescribed for the Eczema by Dr. Jones' permission.

Eczema and sometimes an eruption of boils also are, as is known, not infrequent accompaniments of Diabetes. I am not speaking here of the localized Eczema of diabetics. That condition is limited to the immediate neighbourhood of the orifice of the urinary passage, and is the result of the local irritation set up by the sugar contained in the urine. I am speaking now of constitutional and more or less generalized Eczema, and not of localized and factitious Eczema. In this case the patient, after he had been for three years or more the subject of Diabetes, had become affected somewhat severely with Eczema, which involved a large tract of skin, namely face, neck and upper limbs including the backs of the hands. He was also, when he came under my notice, suffering somewhat severely from a copious eruption of boils, which had affected him for the past five months, and which were scattered

over the back of his neck, on his forearms, and on the backs of his hands. In my view the Eczema, and the boils equally, are in such cases the direct result of the Diabetes. As I have often pointed out on different occasions, Eczema is essentially a disease of debility, a concomitant and an effect of impaired nutrition. More especially, is it a frequent result of 'nervous debility' (*neurasthenia*). I have often traced it as a direct consequence of prolonged mental tension, and I have not infrequently observed a sharp attack of Eczema following promptly after a severe mental shock. Eczema is, by far, more common in infancy and old age than it is at the intermediate period of life: that is to say, it prevails mostly before and after the period of life, during which the constituent cells of the body enjoy their highest degree of vitality. A chronic disease which lowers the vitality and also induces depression of mind, such as Diabetes, may therefore well be credited as a favouring cause of Eczema, and I will add of boils as well.

Having regard to the patient's age, and to the circumstance of his having Diabetes; it seemed to me, when I first saw him, that he was a person extremely likely to have sooner or later another

attack of Eczema; although I felt some confidence that his present attack could be speedily made to vanish. His attack of Eczema and of boils, super-added to his Diabetes, had evidently brought him down very low; and indeed he presented a very decrepit and haggard appearance. He voluntarily informed me that, throughout his life, he had always been a specially nervous and excitable man. His long deprivation of sleep, from the constant and severe irritation occasioned by his Eczema, had told upon him very considerably. I accordingly regarded the probability arising from his Diabetes of renewed severe attacks of Eczema, as a somewhat grave outlook for him. He was in this position namely: that his Diabetes, because of its lowering effect on him, held out a constant menace of fresh attacks of Eczema. While, on the other hand, each attack of Eczema would certainly tend to add very gravely to the low condition already produced by his Diabetes.

It appeared to me therefore, that if I was to be the means of rendering him any permanent service in respect of his Eczema; that is to say, of aiding in the avoidance of future attacks, as well as in ridding him of his present attack, I ought if prac-

ticable to attempt something for the improvement of his Diabetes.

Accordingly, when a new point of departure seemed to have offered itself in the apparent amelioration of his Diabetes by phosphorus, I suggested to Dr. Jones that his patient should be placed, for a short time, under my more immediate observation. I undertaking the task of making exact observations on the patient as to his condition and the influence exercised on it by the administration of phosphorus, and of reporting fully to Dr. Jones such results as might be obtained. To this Dr. Jones willingly acceded.

I have accordingly, owing to the courtesy of Dr. Jones, been able for a short period to make accurate observations on the influence of phosphorus in Diabetes, so far as concerns this particular instance. The period, over which these observations extend, was cut short by the patient's anxiety to get home again to attend to his affairs, which of late he had much neglected; and also by his feeling so much better as to be well able to devote himself again to his business. The details of the case, which are already in the hands of Dr. Jones, can therefore now be set forth with something like precision. The



short period, during which accurate observations were obtained, extended from November the twenty-second to November the thirtieth, both days included. A period, therefore, of nine days only.

The patient was first seen by me on October the twenty-ninth, the day on which Dr. Jones brought him to my house.

On November the second he began phosphorus-treatment, namely, by taking one phosphorus 'perle' three times a day. Each of these 'perles' contain one thirtieth of a grain of phosphorus, dissolved in oil. He continued thus for three days.

On the fourth day of treatment, that is to say on November the fifth; since no nausea had been produced by the phosphorus the dose was doubled, so that he now took two perles three times a day. He continued thus for six days, namely until November the tenth inclusive. Then, because he had nausea, I advised that the 'perles' should for a few days be given up altogether.

Accordingly the treatment by phosphorus was suspended from November the eleventh to November the fourteenth, both days included, therefore for a period of four days.

Then, because the nausea had quite subsided, I



advised the resumption of the perles; but at the lower dose, namely only one perle three times a day. He continued thus, without experiencing any sensation of nausea, from November the fifteenth to November the twenty-first, both days included; therefore a period of seven days.

On November the twenty-second, accurate observations were commenced.

His treatment, previous to November the twenty-second, may thus be summarized:—

For the first three days, gr.  $\frac{1}{10}$  phosphorus daily.

For the next six days, gr.  $\frac{1}{5}$  phosphorus daily.

For the next four days, no phosphorus at all.

For the next seven days, gr.  $\frac{1}{10}$  phosphorus daily.

A period of twenty days in all.

It will be better to relate first, the experience gained during these preliminary twenty days, before proceeding to give the more accurate data obtained during the nine days which followed after.

The total period during which the patient was under my observation, from first to last, was thirty-three days. The period, during which he may be regarded as having been more or less completely under the influence of phosphorus, extends from November the second to November the thirtieth,

both days included; therefore a period of twenty-nine days, (a lunar month and a day).

I have in my 'report,' related the improvement that the patient had undergone when I saw him on November the eleventh.

November the eleventh was the day on which he first made me acquainted with the effect that the phosphorus had exercised in the control of his Diabetes. He had, by then, had only nine days' treatment by phosphorus, having taken for the first three days  $\frac{1}{10}$  grain daily, and for the last six days  $\frac{1}{5}$  grain daily. He had then lost in a great measure, his haggard appearance. He was more 'on his legs,' as the phrase goes. He was brighter, and far more cheerful. Nor was this difficult to account for. His Eczema had almost completely disappeared. His boils were far on the wane. His Diabetes was vastly diminished. More than all, he had at last enjoyed sound sleep at night. He had slept well for three reasons. Firstly the distressing irritation which for a year and eight months had harassed him at night had ceased. Secondly he was no longer obliged to get out of bed as usual four or five times in the night, to pass water. Thirdly he was not compelled, by insatiable thirst, to keep sipping as

usual, through the night, his favourite beverage of milk and tea. For some four or five days past he had slept peacefully through the night, unmolested by any of these, each of them somewhat urgent, disturbers of repose. On the other hand he had just begun to experience a decided sensation of nausea occasioned by the phosphorus, which Dr. Jones and I agreed should now be discontinued until the nausea had subsided.

*On November the fourteenth* Dr. Jones sent him to me again. My notes of that date are as follows. The patient has discontinued phosphorus altogether since November the tenth. The nausea from the phosphorus has only just ceased. Patient states that the nausea commenced on November the tenth, when he felt sickly throughout the day; on the next day (the day on which the phosphorus was discontinued absolutely), he felt just the same; and so also during the day after, (three days in all). Yesterday, (November the thirteenth), he felt better; and to-day, (November the fourteenth), he is quite free from nausea. His Diabetes, he thinks, is now a little worse than it was on November the eleventh; but not as bad, by a long way, as it was on the day when he first came to me. He is now obliged to get

up twice in the night to pass water. This time, on the journey here from Manchester, he passed water twice and drank once only. However that was because he ate a little piece of cake on the way, and even then he did not drink many spoonfuls.

He states that he has had Diabetes for some years. His first attack was five years ago, and he has never been free from the disease since. He has at times got better, and at times worse. Under advice he has taken gluten bread, 'on and off,' for two or three years; and left it off three or four months ago. This gluten bread always seemed to relieve him, but at last he turned against it. When he first came to me he was not taking any potatoes. He was then eating very little bread; but *some* bread, sometimes more sometimes less, every day. He had suffered from his Eczema for about one year and eight months; and from his boils for about five months.

His nausea having now quite subsided he commenced, on November the fifteenth, to take one perle three times a day. He so continued till November the twentieth: the day on which, as arranged by Dr. Jones and myself, he should come to London for a short time.

He called on me on the twentieth to tell me that

he had arrived. I then gave him directions as to accurately measuring daily, at 9 A.M., the quantity of urine passed during the previous twenty-four hours. I also directed him to furnish me daily with a sample taken from the urine previously collected in one vessel. However, inasmuch as these directions could not be carried out until the morning of the twenty-second, it was arranged that we should begin on that day. I directed him to continue meanwhile his one 'perle' three times a day.

*My notes on November the twenty-second* are as follows. The amount of urine passed in the twenty-four hours ending 9 A.M. this morning was sixty-eight fluid ounces. Patient states that he has never before measured the twenty-four hours' amount of urine. But he once measured the amount that he passed during the night. This was a period of about nine hours, since he generally goes to bed at eleven and gets up at eight. On that occasion he found that the quantity passed by him was about two and a quarter quarts. This quantity reduced to fluid ounces is seventy-two fluid ounces, passed in the night of nine hours.

It is now for seven days that he has continued his second course of phosphorus namely at the rate of



one-tenth of a grain a day. He has experienced no nausea or discomfort of any kind from the phosphorus throughout this period. He states that he feels considerably better. He certainly looks so too. Last night he went to bed at about half-past nine P.M. He did not get out to pass water till half-past six A.M. That was the only time he had to get out of bed at night.

Ever since he first came to see me he has been taking the ordinary wheat bread, namely three times a day; but he does not eat much bread at dinner. However, on the whole, he has eaten a pretty fair quantity of bread since he has been in London. As to liquids: he has had two cups of tea this morning at breakfast, and now at half-past noon, he has no desire for any drink. Before he first saw me he used to be drinking every few minutes. He used to be always thirsty. He could have kept sip, sip, sip, all through the day. While thus, he had never taken a drink but that, two minutes after it, he felt as if he would like some more. He usually used to take up a quart of milk and tea mixed (his favourite drink all the time) to his bed-room, and drink it during the night. However yesterday at breakfast he had two cups of tea, then at dinner one tumbler



of weak brandy and water, then at 'tea-time' two cups of tea, then at bed-time two cups of cocoa. Also he has taken quite a small gulp of water each time that he has swallowed a 'perle.' He does not think that he was better during his first four or five days of sudden immunity than he is now. He was better then very suddenly, but he thinks that he is as well now as he was even then.

As to the analysis of his urine, I thought I had better confide that to some one else than myself. The accurate estimation of sugar in diabetic urine is a matter which occupies between two and three hours on each occasion, and I could not afford that time for the purpose every day. Moreover it seemed to me, that if the results of analysis should turn out to be in favour of phosphorus, they would probably have greater authority if arrived at by some independent observer; because in this investigation it would be difficult for me to pretend that I was altogether without a secret hope that phosphorus would prove itself of value. I accordingly applied to one of the chief retail pharmaceutical chemists, a part of whose daily business it is to perform accurate analyses of urine for medical practitioners.

He reported to me as follows respecting this first sample of urine :—

Reddens litmus strongly : Sp. gr. 1033 ; Albumen, faint trace ; Sugar, 25 grs. per fl. oz. of urine, = 1700 grs. in 24 hours ; the amount of urine voided being 68 fl. oz.

Now 1700 grains is exactly 4 ounces. The patient therefore, even in this his improved condition, was passing 4 ounces of sugar a day.

I felt myself to be in a position of peculiar difficulty in attempting the investigation I had undertaken. The object of it was that I might be able to inform Dr. Jones, on something like accurate data, what was the precise effect that this newly found remedy was capable of exercising on his patient's condition. The questions to be solved were these :—Is the patient better of his Diabetes when taking phosphorus, than he is when not taking phosphorus ? If he is better when taking phosphorus how much the better is he ? Pre-existing data there were none ; the patient had never yet measured his twenty-four hours' quantity of urine, nor had it ever yet been measured. Without this first and foremost factor no other datum was of any use ; certainly not specific gravity, certainly not any other datum of whatsoever kind.

If I had at the commencement taken an accurate observation of the urine it would have been everything to me, but at that time I had nothing to do with the Diabetes; and now the patient had been taking phosphorus more or less for very nearly three weeks, and had become greatly improved by so doing. One course would have been to stop his phosphorus, with the view of carefully watching an expected progress from good to bad. This however was out of the question. It was impossible to propose such a course to a man who desired to get all the improvement he could, and as rapidly as possible; who moreover had come to town, at great inconvenience, in order to obtain if practicable more rapid improvement than before.

I accordingly determined to adopt the only course that was open to me, and that was to push the administration of phosphorus, with a view to ascertaining whether that plan would result in a still further bettering of his condition from its present improved state: provided always that any perceptible difference of the kind could be achieved within the few days that were allotted to me. I thought it as likely as not that phosphorus had possibly already done as much for the patient as could

reasonably be expected of it ; and that the further amelioration, if any, to be gained by it during the next few days would be very small. Influenced by this idea I left the dose of phosphorus unaltered for another day, in order that the analysis of the second day might act as a check on the first analysis, so that as accurate a starting-point as possible might be arrived at. *On the next day, November 23rd*, the twenty-four hours' quantity passed by nine A.M. was recorded as sixty-six fluid ounces. I applied to the same chemist as before who reported as follows :—

Reddens litmus strongly ; Sp. gr. 1033 ; Albumen, faint trace ; Sugar, 27·3 grains per fl. oz. of urine, = 1801·8 grs. in 24 hours, the amount of urine voided being 66 fl. oz.

This was an increase, namely, to 4 oz. and 101·8 grs., instead of 4 oz. as yesterday. Having now obtained, as I thought, a sufficiently accurate starting-point, I directed the patient to double his dose on the following day.

As to the quantity of fluid that he drank on the previous day, he tells me that he drank about 58 fluid ounces, as nearly as he can judge. He has, in accordance with directions I had given him, ascertained the capacity in fluid ounces of the cups and

glasses he drinks from, when filled to the height that he usually fills them. He accordingly makes up the tale of his daily potations thus. Two cupsful =  $17\frac{1}{2}$  fl. oz. He takes four of such cupsful = 35 fl. oz. A glass of brandy and water = 7 fl. oz. Gulping water for the 'perles,' 7 fl. oz. One cup of cocoa = 9 fl. oz. Total 58 fl. oz.

As to injurious articles of diet. He ate 12 oz. bread, as near as he can guess. Then he had 2 or 3 spoonfuls of mashed turnips, and a small quantity of potato. He informs me that, as to his boils, he has suffered from them for a period of about five months.

*November the twenty-fourth*, the day on which he commenced taking the double dose of phosphorus, was a Sunday. Accordingly no analysis was made on that day. The twenty-four hours' quantity of urine, collected at nine A.M., was sixty-one fluid ounces.

*On November the twenty-fifth* the twenty-four hours' amount taken at nine A.M. was fifty-two and a half fluid ounces. This was of course the urine passed during the first day of his taking the double dose, and during the night following on that day.

The analysis made by the same chemist as before



whom I will distinguish as chemist A, was as follows :—

Reddens litmus; Sp. gr. 1030; Albumen, faint trace; Sugar, 20 grains per fl. oz. of urine, = 1050 grs. in 24 hours, the amount of urine voided being  $52\frac{1}{2}$  fl. oz.

I was as much astonished at this sudden drop in the daily production of sugar as I was when the patient confided to me the first amendment of his Diabetes. If the analyst was to be believed, a doubling of the dose of phosphorus, on the very first day of this doubling, brought the daily production of sugar from 1801·8 grs. down to 1050 grs.,—had diminished it, in fact, by nearly one-half.

My notes of this date are as follows: Patient states that, although he has never measured his twenty-four hours' urine until the last three or four days, he feels sure that since he was first ill with Diabetes, five years ago, he has never passed so little water in the twenty-four hours as he is passing now. He says he has never, during the past five years, passed anything like so small a quantity as this. He states that he can now go, from meal to meal, without requiring to drink anything between meals; and that he does not even feel any wish for liquid



between meals. He says that, when he first came to me, he was always craving for liquid and wanting to sip. He states that he can discern that his arms are thicker, and that there is more flesh on them than when he first saw me. He has taken bread as before, but has respected a remonstrance I made when he told me of the turnips and potatoes. He has accordingly avoided these and taken, instead, green vegetables, namely brussels-sprouts.

*On November the twenty-sixth.* The twenty-four hours' urine measured at nine A.M. amounted to sixty fluid ounces. He is still taking the double dose of phosphorus as before and, as yet, without any feeling of nausea.

The analysis of chemist A was as follows:—Reddens litmus; Sp. gr. 1024; Albumen, faint trace; Sugar, 11·6 grains per fl. oz. of urine = 696 grs. in 24 hours, the amount of urine voided being 60 fl. oz.

This was a further surprising statement. The amount of sugar had, in one day, gone down from 1050 grs. to 696 grs. Only two days of the double dose of phosphorus had sent the amount of sugar from 1801·8 grs. down to 696 grs.

But chemist A had startled me sufficiently on the

day previous. Accordingly I had requested the patient to bring two samples of urine with him on this occasion. One of these I had sent to chemist A as before, but the other I sent to a gentleman whom I will call chemist B. B, like A, is a leading retail pharmaceutical chemist, and equally versed in the accurate analysis of urine. His analysis was remarkably different from the analysis of A, I mean as to the main question, namely the amount of sugar.

B reported as follows: Reaction acid; Sp. gr. 1024; Albumen, none; Sugar, 6.5 grs. in 1 fl. oz. of urine, = 390 grs. of sugar in 24 hours, the amount of urine voided being 60 fl. oz.

This rather broad difference between the two analyses was discouraging, the more so on account of the evident care taken by either analyst in the matter of decimals, which after all were fairly alike in the two analyses. But in the matter of grains, A was nearly the double of B. It was clear that the difficulties of my investigation were vastly increased by this disclosure. However I determined to adhere loyally to A throughout. If I had known what was going to happen, I would have engaged at least two analysts from the beginning, to see if their

comparative progress through a series of days would exhibit any sort of relation. If A was wrong and B right, I trusted to A erring in the same sort of way throughout. Indeed I had now nothing else to trust to.

*On November the twenty-seventh* the twenty-four hours' urine taken at nine A.M. amounted to sixty-two fluid ounces.

Analyst A reported on it as follows:—Acid reaction; Sp. gr. 1023; Albumen, faint trace; Sugar, 9.5 grs. per fl. oz. of urine, = 589 grs. in 24 hours, the amount of urine voided being 62 fl. oz. This indicates a further fall of more than a hundred grains in a day.

This time I thought I would check A by applying to a Professor of Chemistry of one of the London colleges, who was also a Fellow of the Royal Society. I will distinguish him as analyst C.

He reported as follows:—Sp. gr. 1022; Sugar,  $6\frac{3}{4}$  grs. per fluid ounce of urine, =  $418\frac{1}{2}$  grs. in the 24 hours, the amount of urine voided being 62 fl. oz.

There is at least one excellent feature in this analysis and that is the absence of decimals.

In this case the result of A is about half as much

again as that of C. It is further to be remarked that if B and C should, each of them be taken as correct, and the evidence of A be rejected; then, in such case, there was a slight *increase* of sugar since yesterday, instead of a considerable fall as recorded by A.

My notes of this day's date are as follows. Patient states that ever since he was first affected with Diabetes he never has been at a better pitch than he is now. He goes mainly by the fact that the craving desire for drink seems to have left him entirely for he has now no desire for drinking between meals, either by day or by night. He repeats that he has never, during the past five years, been so well as he is now, either as regards the thirst or as regards his general feeling. During the whole of those five years he has never been anything like so well as he is now.

However to-day he suffers from nausea, and feels as if he would like to vomit. He has had that feeling ever since he took his last dose last night. Up till now he has taken two perles three times a day, namely since the morning of November the twenty-fourth, therefore for three days in all. He took two perles this morning, but he felt against

doing so. I accordingly directed him now to take only one perle more to-day, making three in all for to-day, and requested him to continue with three perles a day only.

It will be noticed that his tolerance of phosphorus, on this second occasion of the drug being 'pushed,' was less than on the former of the two occasions. On the former occasion the double dose (commenced on the morning of November 5th), did not produce nausea until the morning of November 10th. On this second occasion the double dose (commenced on the morning of November 24th) produced nausea as early as the evening of November 26th. That is to say within about half the time it took before.

He mentioned to-day that, for the last few months, his capacity for enduring fatigue had become considerably diminished, and that during this period he has always felt quite tired after a mile walk.

It will be perceived, from the tenour of these notes, that I fell back on the patient as being perhaps the best analyst of the four. He at all events could 'analyze his feelings' as the novelists say, and 'estimate' his own thirst.

*On November the twenty-eighth* the twenty-four hours' urine taken at nine A.M. amounted to sixty-



seven fluid ounces; that is to say five fluid ounces more than it was on the previous day. But the day to which this urine belongs, namely yesterday, was quite a chilly day.

Of this urine analyst A reports as follows:—Reddens litmus; Sp. gr. 1017; Albumen, faint trace; Sugar, 7.28 grs. per fluid ounce of urine, = 485 grs. in 24 hours, the amount of urine voided being 67 fl. oz.

Here was another fall of more than a hundred grains in a day, as computed by A.

On this occasion I thought I would check A by quite a new analyst, whom I will call analyst D. This gentleman is a Fellow of the Institute of Chemistry, and his entire services are retained by a leading firm of wholesale druggists, to whom I applied. I was given to understand, by a representative of the firm, that the duties of their analyst were to discharge analytical functions, those and those only.

This gentleman reported as follows:—Distinctly acid reaction; Sp. gr. 1016 at 60° (Fahr.); no albumen; Sugar, 1.88 grains per fluid ounce of urine, = 125.96 grains in 24 hours, the amount of urine voided being 67 fl. oz.



As to the deposit in the urine, he adds :—

Examination of deposit, by microscope, shews two or three crystals of uric acid, epithelia, and sugar fungus.

This was a sadder, if a wiser, result than any I had yet purchased. The number of grains of sugar was less than a third of the quantity found by A, and yet the sample supplied to D was identical with the sample supplied to A.

Of course, if D was to be believed, then the patient was indeed improved since the twenty-third, when according to A the amount of sugar was 1801·8 grains: instead of as now, on the twenty-eighth, only 125·96 grains, as recorded by D. If both are to be believed, (which is absurd,) then the potency of phosphorus in this particular case of Diabetes must be considered as established.

But if A is to be discredited on this occasion, a misgiving as to his 1801·8 grains cannot be escaped from.

My notes of this date are as follows. Patient managed to get down another 'perle' yesterday morning, making three 'perles' in all for that day; but all yesterday, (the twenty-seventh,) he felt a sickly disagreeable sensation throughout the day.

On this account he did not take very much food yesterday. He had no desire to drink, and he thinks that he drank less yesterday than on any day of his stay in London. He observes, as to his treatment by the perles, that the perles seemed, from the very time when he first commenced to take them, to quench his thirst. This he says is the great improvement, and he feels much contented with this, namely that his thirst has gone. I note that the urine that he brought me to-day is turbid but, as I have already mentioned, the day during which it was collected, namely yesterday, was quite a chilly day. The turbidity is therefore probably a mere precipitation of the lithates, owing to the urine being exposed to a low temperature. It is arranged that to-day, as to the 'perles,' he is to do as he may choose. To-day he has already taken one 'perle.' This morning he was sick, that is to say he actually vomited a little, this occurred before breakfast and before taking this one 'perle.'

*On November the twenty-ninth* the twenty-four-hours-urine, taken at nine A.M., amounted to fifty-eight and a half ounces.

Analyst 'A' reports on it as follows:—Reddens

litmus; Sp. gr. 1026; Sugar, 6·5 grains per fluid ounce of urine, = 380·5 grains in the 24 hours, the amount of urine voided being  $58\frac{1}{2}$  oz.

This indicated a further fall of more than a hundred grains of sugar in a day.

On this occasion the urine was much more turbid than on the previous occasion; but the cause was probably the same, namely a precipitation of lithates; because yesterday was even a colder day than the previous day. It was in fact a bitterly cold day. This time I did not consult a second analyst but, instead of doing so, I sent a sample of the urine to Dr. Lionel Beale for microscopical examination.

He reported as follows:—

Amongst the urate (lithate), which is in large quantity, are many leucocytes or pus-like corpuscles, and a few blood corpuscles. Many of the former are in collections, and some in lines looking like casts; but there are no true casts that I can find. There is also some epithelium from the bladder and from the pelvis of the kidney, and many long shreds of mucus. If there has been dull pain in the region of one kidney, there is probably a small stone, or some crystals irritating the tubes. There are no indications of chronic renal disease (structural).

My notes of to-day are as follows:—

Patient states that the quenching of his thirst for the last few days, is beyond what he could have 'dreamed about.' Altogether he took two 'perles' yesterday. He vomited slightly a second time yesterday, and also this morning, and felt sickly all yesterday and all last night. He is directed now not to take any more 'perles.' He says that he *cannot*.

*On November the thirtieth* the twenty-four hours' urine measured at nine A.M. to-day amounted to fifty-one fluid ounces.

Analyst A reported as under:—

Reddens litmus; Sp. gr. 1026; Sugar, 7·2 grains per fluid ounce of urine, = 367·2 grains in 24 hours, the amount of urine voided being 51 ounces.

On this occasion I reverted to analyst B to check for the last time analyst A.

He reported as under:—

Reaction acid; Sp. gr. 1024; Albumen, none; Sugar,  $4\frac{1}{2}$  grains per fluid ounce of urine, = 230 grains in 24 hours, the amount of urine voided being 51 ounces.

Here, as on the other occasion on which B was pitted against A, the quantity of sugar found by A. is nearly double the quantity found by B.

It is interesting, however, to compare the two analyses of B one with the other.

On November the twenty-sixth B found 390 grains.

On November the thirtieth B found 230 grains.

So that B backs up A, at least in this particular, namely that he also found a distinct diminution of the sugar at the later date.

My notes of to-day are as under:—

Patient now brings with him some toast, which I find weighs exactly one ounce and a half (Avoir-dupois). This represents the quantity that he ate yesterday of toast, (he ate no untoasted bread). This is the quantity of toast per diem that he has eaten since he has, (for the last day or two), felt nausea. He took no phosphorus ‘perles’ yesterday. His nausea has not quite left him, even this morning. It is leaving him, but it has not quite gone altogether. The sample of urine he brings with him this morning is perfectly clear and transparent. He tells me that he went yesterday to ‘Barnum’s Show,’ leaving home at 1.30 P.M., and returning home by 5.45 P.M. He did not pass water during this absence from his lodgings, nor had he any desire to do so, nor did he feel any pressing call to do so when he got back.



As to what he drank yesterday. He drank at breakfast a cup and a half of tea. The cup held eight and a half fluid ounces. Therefore he drank twelve and a quarter fluid ounces in all at breakfast. At lunch he took two soup-platesful of clear soup. He thinks each soup-plate holds about the same quantity as a breakfast cup. So that at lunch he took seventeen fluid ounces. At 6 P.M. he had a cup-and-a-half-ful of tea; therefore twelve and a quarter fluid ounces. At 10 P.M. he had a cupful of clear soup; therefore eight and a half fluid ounces. This is all the liquid he took in the day; therefore fifty fluid ounces in all.

As to what he ate yesterday. At breakfast he had dry toast and bacon. At 1 P.M. dry toast with his soup. At 6 P.M. dry toast and a chop. That is all that he ate.

As to the quantity of toast that he took before he began, (two or three days ago), to feel qualmish; he thinks he took about half as much again as he is taking now, therefore two and a quarter ounces of toast. In reply to my inquiry, as to whether he found this quantity sufficient to satisfy him, he replied that it was sufficient. He adds, that if he had not the idea of avoiding taking more bread than

he actually needs, he might perhaps have eaten bread more lavishly; but that, in limiting himself to the quantity he takes, he has not denied himself in any degree.

To-day the patient left London for Manchester. He said that he now felt quite well enough to attend to his business and was anxious to get home again.

As the result of my close observation of the patient, although this was limited to so short a period, I felt justified in recommending to Dr. Jones a continuance of the phosphorus-treatment at the lower dose, namely, one 'perle' three times a day. In framing this recommendation I had nothing to go upon, except the observations I have here recorded, since so far as I know phosphorus has never before been used as a remedy against Diabetes. However the result of these observations seems to me by no means a doubtful one.

It is a matter of regret to me that my analysts failed to agree. Many observers would have been content with analyst 'A,' without going further and seeking to analyse his analyses. If I had been content to leave him unquestioned, the table I have drawn up of his analyses would have left me in possession of a record of a very conclusive kind.

The subjoined table conveys at one view the  
 EXPLANATION.—The dates refer to the urine collected at  
 the analysis referred to is the analysis of the twenty-four-  
 The mean daily temperatures, copied from the *Times* newspaper,  
 So that the temperatures refer, each of them, to the  
 The treatment stated for each date refers, however, to the

Analyst employed.	Date on which the Analysis was made.	Specific Gravity of the 24-hours-Urine.	Quantity of Sugar per Fluid Ounce of Urine in Grains.	Quantity of the 24-hours-Urine in Fluid Ounces.
Analyst 'A' . .	Nov. 22	1033	25	68
" . .	" 23	1033	27·3	66
" . .	" 24	..	..	61
" . .	" 25	1030	20	52½
" . .	" 26 *	1024	11·6	60
" . .	" 27 †	1023	9·5	62
" . .	" 28 ‡	1017	7·28	67 [urine cloudy]
" . .	" 29	1020	6·5	58½ [urine very cloudy]
" . .	" 30 §	1026	7·2	51 [urine bright again]
Analyst 'B' . .	* Nov. 26	1024	6·5	60
Analyst 'C' . .	† Nov. 27	1022	6·75	62
Analyst 'D' . .	‡ Nov. 28	1016	1·88	67
Analyst 'B' . .	§ Nov. 30	1024	4·5	51

results obtained during the nine-days-investigation.

9 A.M. on the day named. Thus, the date Nov. 22 indicates that hours-urine collected at 9 A.M. on Nov. 22.

are placed opposite the dates on which they were published. previous twenty-four hours just as in the case of each analysis. actual date stated, and not to the previous twenty-four hours.

Mean Daily Temperature in London copied from the <i>Times</i> .	Quantity of the 24-hours-Sugar in Grains.	TREATMENT. [Note that for the twenty days preceding Nov. 22, the patient had taken, on an average, one 'perle' three times a day.]
38°	1700	1 'perle' 3 times a day.
49°	1801	Ditto.
..	..	2 'perles' 3 times a day.
50°	1050	Ditto.
41°	696	Ditto.
37°	589	[Nausea]. 1 'perle' 3 times a day.
35°	485·7	[Nausea]. 1 'perle' twice a day (of these 1 was rejected).
34°	380·25	[Nausea]. No 'perles.'
39°	367·2	[Slight nausea]. No 'perles.'
41°	390	
37°	418½	
35°	125·96	
39°	230	

The record of his analyses shows a diminution in the diurnal quantity of sugar from 1801·8 grains to 367·2 grains, and this in the short space of seven days. That surely would be a sufficiently favourable result. But I was too curious, and I cannot avoid the consequences of my curiosity. The balance of evidence seems to show that 'A' was not altogether reliable. The three other analysts that I employed differed from him, each of them, in the same kind of way. They made out his estimation of sugar to be a great deal too high. Nevertheless I feel reason to believe that he has shown himself worthy of the somewhat guarded confidence that I have throughout reposed in him. I had entertained a hope regarding 'A,' which perhaps I shall best express in the words of Horace

'. . . servetur ad inum

Qualis ab incepto processerit, et sibi constet.'

I think my expectation has been justified. I believe that he has erred in the same sort of way all through, so that his scale is probably correct, although it is pitched a great deal too high. Some colour for this assumption is to be derived from the results of the two analyses of chemist 'B,' which, each of them, was a little more than half of the correspond-



ing result obtained by 'A.' So that, in an odd sort of way, there is a concordance between the analyses of 'A' and, so far as they go, those of 'B.' In short, I conclude that the analyses of 'A' were fairly correct, provided that each of them be divided by two. That is the nearest guess that I can make as to the analyses.

But, after all, one is not quite helplessly dependent on analysts in framing an opinion on the main question, and that is:—Did phosphorus unquestionably benefit this patient? Sugar in the urine reveals itself in other ways than by analysis, for example by a high average specific gravity of the urine. Now on the question of specific gravity all of the four analysts were fairly in accord. We see, by reference to the tabulated figures, that, on the average, the specific gravity diminished very notably towards the close of the six days. If the specific gravity for each day be corrected, as it always should be, by the twenty-four hours' quantity of urine passed; then this diminution becomes much more obvious. Sugar in the urine declares itself, also, by an increased flow of urine. The tabulated figures show a notable average diminution in this respect also: a diminution which becomes still more obvious if the quantity of

urine for each day be corrected, as it should be, by the mean temperature of that day. Sugar in the urine declares itself, also, by the distressing thirst which it provokes. Now there can be no doubt, from the history of this case, that the patient's thirst became very greatly relieved. Therefore the general tenour of the results obtained by 'A' is borne out, not only by similar testimony on the part of 'B': but also by such significant indications as a fall in the specific gravity of the urine, and coincidently a quenching of the patient's thirst.

Now, taking all of these indications together; there can be no doubt that, within the six days, the patient underwent very notable improvement.

Also his improvement was a very sudden one. On the very day (Sunday) when he first commenced to double his dose of phosphorus, his improvement declared itself in a very unequivocal manner. The urine, collected during that Sunday and during Sunday night, proved, when examined on Monday morning, that he had undergone a considerable amendment on that very Sunday. As compared with the urine passed only two days before, when he was taking only half the quantity of phosphorus, the difference was a very decided one. So far as the

analysis of A may bear on the matter :—the quantity of sugar per fluid ounce had sunk from 27·3 grains down to 20 grains : the twenty-four hours' quantity of sugar had sunk from 1801 grains down to 1050 grains. What, however, is more certain, is that the specific gravity of the urine had sunk from 1033 to 1030, and that the twenty-four hours' quantity of urine had sunk from 66 fluid ounces down to  $52\frac{1}{2}$  fluid ounces.

That this vast diminution of the twenty-four hours' quantity of the urine was, in part, due to a rise in the mean daily temperature : must be admitted. But, on the other hand, it is to be borne in mind that, if the quantity passed had not been thus influenced, the fall in the specific gravity of the urine would have indicated itself in a still more accentuated manner.

I can well imagine that my investigations are open to quite a different view from that which I myself take of them. It might be said to me, 'You claim 'a six-days' continued average improvement, from 'the augmented dose of phosphorus. But you claim 'that the improvement began on the very day that 'you augmented the dose. Why ! the increased dose 'could not have had time to make its influence felt

‘until at least a few days after the augmentation of dose. Moreover, you did not continue the augmented dose during the whole of these six days, but only on the first three of them : and on the last day you actually gave no phosphorus at all!’ I think I have already disposed of the former of these assumed objections. Now, as to the latter : I have to point out that nausea, arising from the influence of the augmented dose, made itself fully felt during the whole of the last three of these six days. It is therefore only reasonable to suppose that, if the effect of the increased dose continued to declare itself in the one manner, its influence would persist for quite as long in the other matter also.

I infer from my observations that the effect of phosphorus on Diabetes is an influence which exerts itself immediately, and continues to assert itself for at least a few days after the administration of the phosphorus has been discontinued.

I feel no doubt that, if I had been able to take exact observations of the patient’s condition before he began taking any phosphorus, and had then commenced treatment by administering the double dose, I should in such case have obtained results of a much more striking character. But, in this case,

the patient had been already taking phosphorus for three weeks, before I began to take my record of him; and there can be no doubt that he had already benefited, very considerably, before I commenced my observations on him. Already, his thirst had become greatly assuaged, the quantity of urine that he passed had become greatly diminished—(‘dried-up’ as he expressed it), and his general condition had become notably improved.

But this is not the only cause that prevented phosphorus showing at its best during my six-days-enquiry. Another circumstance has to be taken into account, namely, that the patient’s diet was not restricted. He was not deprived of starch-containing food. He was not ordered bran-biscuits, or almond-cakes, or ‘gluten-bread,’ in place of ordinary bread.

He had, for long, discontinued the diet to which diabetics are customarily restricted; and which always, for so long as it can be persevered with, benefits them. He had left off taking gluten bread, in place of ordinary bread, three or four months before he first saw me. When he first came to me he was not, it is true, taking potato, but he was taking bread, although not very much of it, every day.



When he was undergoing his first course of phosphorus, his diet remained unaltered, he continued taking bread as before; and yet, notwithstanding this drawback, the phosphorus rapidly effected an amendment of his Diabetes, which was sufficiently pronounced to arrest his attention, although he was not expecting any improvement of the kind. Indeed the merit of discovering the effect of phosphorus on Diabetes belongs to my patient rather than to myself.

He continued taking bread, as before, for the whole of the twenty-days' period, during which he was under treatment by phosphorus, before I began to take exact observations of his condition.

When I commenced exact observations, I naturally made particular enquiries of him as to whether his diet still remained unaltered as before. He then informed me that, for the two or three days he had already spent in London, he had taken more bread than usual. He explained that the people he was lodging with did not keep so good a table as he had been accustomed to, and that he consequently had to fall back upon bread to supplement the somewhat meagre fare that was provided for him. On the twenty-second of November he took in addition,

a small quantity of turnip and potato, which perhaps will explain the slight increase of sugar in the urine which was noted on the morning of November the twenty-third. I remonstrated with him, on the importation of such perplexing items as turnip and potato into our calculations; and enjoined him, as to the matter of diet, to go on exactly as he had gone on before. This injunction, I have every reason to feel assured, was carefully attended to by him. I was desirous of ascertaining what influence could be exerted on his disease by phosphorus, not by diet. I accordingly arranged matters, so that I might be able to see what headway phosphorus was capable of making against a starch-containing diet.

One of the greatest of the various miseries to which diabetics are subject, is the necessity always enjoined on them of avoiding all saccharine and starch-containing foods; or, the craving for such foods which always sooner or later ensues on such restriction. Now, during the whole of the time that the patient was under my observation, he continued to take such quantity of saccharine and starch-containing food as, in his opinion was sufficient to satisfy him completely.

As to the dose of phosphorus that was administered

in this investigation. It will have been noticed that, when I first commenced treating the patient by phosphorus, I directed one 'perle' to be taken three times a day, for three days; and recommended that, if no nausea was produced by the end of that time, the dose should then be increased to two 'perles' three times a day. It is obvious, from the account I have given of the effect of phosphorus in this particular instance, that six 'perles' a day proved to be too large a dose for the patient's tolerance for longer than a very few days. On the first occasion, when he took this augmented dose, nausea came on after five days' persistence with this dose; and, on the second occasion, after two and a half days' persistence. On the other hand, a dose of one 'perle' three times a day quite failed, as he assured me, to occasion him any inconvenience whatsoever; he experienced only considerable benefit without drawback of any kind.

My reason for commencing with the lower dose in the first instance was, because he was evidently much shattered so that I did not think he would be likely to tolerate a higher dose. However, as it was of some moment to him that he should be mended as rapidly as possible; I decided that the dose should,

after a few days be increased, provided that it should be discontinued on the first appearance of nausea.

No doubt, to many practitioners, a dose even of three 'perles' a day may seem a very high one. But my impression is, that if the patient had not become greatly reduced by the combination of ailments under which he had for so long suffered, he would have readily tolerated at least six perles a day, for at all events a fairly prolonged period—a month or somewhat more.

Before I published, some years since, the results of my investigations into the action of phosphorus on skin-diseases; the dose of phosphorus that was usually given, in the diseases to which its use was then as a rule restricted, namely, diseases of the nervous system, was one-thirtieth of a grain a day. However, about twelve years ago, I carefully tested the effect of phosphorus in some of the more important diseases of the skin, Eczema, Psoriasis, and so forth. While thus engaged I, at the same time, made accurate observations with a view to determining what maximum dose of phosphorus could be tolerated without inconvenience.

In the *British Medical Journal* of November the third 1877, I contributed an article in which I

narrated the case of a girl aged  $13\frac{1}{2}$  affected with Psoriasis. To her I administered phosphorus continuously for forty-seven days : namely, for the first day, three perles in all : for the next three days, six perles daily : for the next eight days, 3 perles daily : then, for two days, six perles daily : then, for six days, three perles daily : then, for thirteen days, six perles daily : then, for seven days, nine perles daily : and for the last seven days, twelve perles daily. The result was, that by the end of the forty-seven days she had lost the greater part of her eruption ; although no treatment of any other kind, whether dietetic or medicinal, was employed, but only treatment by phosphorus. In this case the dose was always immediately diminished whenever discomfort was produced by the administration of the phosphorus.

I concluded my article with the following remarks : — ‘ I ought here to draw attention to the fact that ‘ my case shows that the dose of phosphorus, when, ‘ even as here, it is at first tolerated only with ‘ difficulty ; may be *gradually* increased, even in the ‘ case of a child, to a dose considerably beyond the ‘ limit which is commonly assigned to it. In short, ‘ that, if caution be exercised, four times the ordinary ‘ (one-thirtieth of a grain) dose, namely, as much



‘as one-eighth of a grain, may be quite safely  
‘given without inconvenience of any kind, three  
‘times a day. I have since given this latter dose in  
‘a large number of cases of Psoriasis.’

Now to this I have to add that further experience has since proved to me that many persons are unable to tolerate well a dose higher than three perles three times a day.

Since the publication of my article, in 1877, a stimulus has been given to the employment of phosphorus in the treatment of skin diseases. So that notwithstanding some recent opposition to its use for this purpose, it is now very commonly prescribed in cases of Psoriasis, Eczema, and other allied affections of the skin.

It will be understood that I do not put forward phosphorus as a ‘cure’ for Diabetes: that is to say, I do not profess that I have grounds for believing that it is capable of permanently ridding a patient of this disease, or of ridding him completely of it even for a time. That is of course possible, but I do not think it by any means probable. All that I can venture to say is, that I believe phosphorus is capable of controlling Diabetes in a very marked degree.

Much further investigation, than I have been able as yet to make, is necessary in order to determine whether phosphorus is able to control all, or even the majority, of cases of Diabetes. In any case the value of phosphorus in this disease is a question to be determined, not by the results obtained by one observer but, by the general verdict of the profession. If the efficacy of phosphorus in Diabetes should at length come to be thoroughly established, that drug will be a valuable addition to the means at present available for dealing with this condition.

The chief means at present at our disposal for controlling Diabetes are, as I take it, diet and opium—diet which cannot be continued for long without exciting a disgust so insuperable that it cannot be prolonged indefinitely—and a drug which cannot be persevered with without, in the case of many persons at least, dragging the patient down to the miserable position of a hopelessly confirmed opium-eater.



